

RESIDUE REQUIREMENTS	
TEST PROPERTY	SPECIFICATION LIMITS
Penetration @ 25 C, min	30
Ductility @ 25 C, min @ 4 C, min	150 100
R and B Softening Point, F, min	140
Cement Mixing Test	Waived

The latex modified emulsion, after standing undisturbed for 24 hours, shall be a uniform color throughout.

923.06 MIX DESIGN. The mix design shall conform to the following:

The stability shall be a minimum of 1800 lb and the flow shall be 0.06 to 0.16 in. when tested as specified in T 245, Modified (modification permits air drying of the mixture at 70 to 75 F for a minimum of 24 hours, followed by placement in a 140 F oven and drying to a constant weight prior to reheating and placing in molds).

SECTION 924 THRU 949 — RESERVED

SECTION 950 — TRAFFIC MATERIALS

950.01 PRECAST CONCRETE TRAFFIC BARRIER. Precast concrete traffic barrier shall conform to the Contract Documents. Welded wire fabric shall conform to 908.05.

950.02 RESERVED.

950.03 REFLECTORIZATION OF SIGNS AND CHANNELIZING DEVICES. Unless otherwise specified in the Contract Documents, retroreflective sheeting for signs shall conform to 950.03.02. Retroreflective sheeting for channelizing devices shall conform to 950.03.02 or 950.03.06.

950.03.01 Type II Retroreflective Sheeting. When specified in the Contract Documents, engineering grade retroreflective sheeting shall conform to D 4956, Type II.

950.03.02 Type III Retroreflective Sheeting. Type III retroreflective sheeting shall conform to D 4956, Type III and the following:

MINIMUM REFLECTIVE INTENSITY VALUES FOR TYPE III SHEETING Minimum Coefficient of Retroreflection (R_A) cd/(lx · m²)								
Observation Angle°	Entrance Angle°	Silver- White	Yellow	Red	Orange	Green	Blue	Brown
0.2	+50	75	40	8.4	25	10.3	2.9	1.6
0.5	+50	35	20	6.8	10	6.4	2.0	1.1

The Contractor shall furnish certification as specified in TC-1.02 that the reflective sheeting conforms to these requirements for each batch.

950.03.03 High Performance Wide Angle Retroreflective Sheeting. High performance wide angle retroreflective sheeting shall conform to D 4956, and the following:

MINIMUM REFLECTIVE INTENSITY VALUES FOR HIGH PERFORMANCE WIDTH ANGLE PRISMATIC LENS SHEETING Minimum Coefficient of Retroreflection (R_A) cd/(lx · m²)								
Observation Angle°	Entrance Angle°	White	Yellow	Red	Orange	Green	Blue	Fluorescent Orange
0.2	- 4	800	660	215	450	75	43	200
0.2	+30	400	340	100	250	30	20	120
0.2	+50	35	23	6.6	16	1.8	1.0	50
0.5	- 4	200	160	45	120	18	9.8	80
0.5	+30	100	85	26	70	10	5.0	50
0.5	+50	30	20	6.4	16	2.5	2.0	20

950.03.04 Temporary Roll Up Warning Signs. Temporary roll up warning signs shall conform to D 4956, Type VI.

950.03.05 Black Sheeting. Black sheeting shall be nonreflective.

950.03.06 Type VI Retroreflective Sheeting. Type VI retroreflective sheeting shall conform to D 4956, Type VI.

950.04 OVERHEAD SIGN STRUCTURES. Structural steel shall conform to A 709, Grade 36; steel tubes or pipes shall conform to A 595, Grade A or API 5-LX52. Design and minimum thickness of material

shall conform to AASHTO Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. All steel shall be galvanized as specified in A 123. Hardware shall be galvanized as specified in A 153.

950.05 BACKFILL MATERIAL FOR TRENCHES FOR BURIED CABLE. The lower 1 ft depth of trench shall be fine aggregate conforming to Section 901. Material above the 1 ft depth shall be select material conforming to Section 916.

950.06 ELECTRICAL CABLE AND WIRE. Electrical cable and wire shall be the standard commercial product of the manufacturer and shall have been manufactured not more than one year prior to the date of the Contract. All cable and wire shall be made of copper.

950.06.01 Direct Burial Cable. Direct burial cable shall be single conductor, stranded, with an unshielded, chemically crosslinked thermosetting polyethylene insulation rated for 600 volts. The cable shall be suitable for direct earth burial or installation in ducts or conduit and shall conform to Underwriters' Laboratories Type USE, XHHW or THW and shall bear the applicable UL labels denoting type, size, stranding, manufacturer's name and surface marking or molded ridges for phase and neutral identification. Sizes shall be as specified in the Contract Documents.

950.06.02 Building Cable and Wire. Building cable and wire shall be 600 volt, plastic insulated, nylon jacketed and shall conform to Underwriters' Laboratories Type THWN/THHN and shall bear the applicable UL labels denoting type, size, stranding, manufacturer's name and surface marking or molded ridges for phase and neutral identification. Sizes shall be as specified in the Contract Documents.

950.06.03 Cable Duct. Cable duct shall consist of cables preinstalled in either a polyvinyl chloride (PVC) or polyethylene (PE) plastic duct conforming to NEMA TC 7 and the NEC. PVC shall conform to D 3485. PE duct shall be manufactured from black, virgin, high density PE resin conforming to D 1248, Type III, Grade P34, Class C, Category 5. Minimum inside diameter of duct shall be 1-1/2 in. Cable shall be rated for 600 volts.

950.06.04 Ground Wire and Rods. Ground wire shall be bare medium drawn copper. Ground wire installed underground shall be of the size (solid or stranded) configuration shown in the Contract Documents. Ground rods shall be 0.75 in. diameter, a minimum of 10 ft in length, with a steel core and copper jacket.

950.06.05 Traffic Signal Cable. Traffic signal cable shall conform to IMSA Specification 19-1, and shall be stranded. Conductors shall be No. 14 AWG.

950.06.06 Loop Detector Lead-In Cable. Loop detector lead-in cable shall be two conductor, No. 14 AWG, PE jacketed, conforming to IMSA Specification 50-2.

950.06.07 Loop Detector Wire. Loop detector wire shall be single conductor, 600 volt, No. 14 AWG, 19 strand wire in a flexible PE tubing.

950.06.08 Voice Grade Communication Cable. Self-supporting cable shall be solid No. 19 AWG and conform to IMSA 40-4. Underground cable shall conform to IMSA 60-2.

950.06.09 Electric Service Wire. Electric service wire for traffic signals, intersection control beacons, hazard identification beacons and luminaires mounted on traffic signal structures shall have three individual wires. Each wire shall be seven stranded. Electric service wire color identification by spray paint, tape, heat shrink tubing, or any other after manufacturing method is prohibited.

950.07 LIGHTING STRUCTURES. Lighting structures shall conform to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, based on 90 mph wind loads, luminaire weight of 70 lb and luminaire projected area of 3 ft².

Ground mounted lighting structures shall consist of a one piece, round tapered shaft, a cast steel anchor base for steel structures and a cast aluminum base for aluminum structures, bracket arms, complete with all necessary accessories including anchor bolts, pole top, shims, grounding lug, and handhole.

Steel shafts shall conform to A 595, Grade A. After forming and welding, the shaft shall have a smooth finish with only one longitudinal weld and no transverse welds. Steel bracket arms and mounting brackets shall conform to A 53, Schedule 40. Structures shall be either mechanically or hot-dipped galvanized. The coating shall conform to the thickness, adherence, and quality requirements of A 123.

Aluminum shafts and bracket arms shall be spun from one piece of extruded tubing conforming to B 241, 6000 T6 series alloy. The shaft and bracket shall be cold worked to form the required taper.

Each lighting structure shall be provided with a permanent tag which shall be 2 x 4 in. fabricated from clear anodized 1/16 in. thick aluminum. The edge shall be smooth and corners rounded and the tag shall fit the

lighting structure shaft. Tags shall be secured to shafts by means of four 1/8 in. diameter 18-8 stainless steel round head drive screws or self-tapping screws. The identifying letters or numerals shall be a minimum of 3/4 in. high with a minimum stroke of 3/16 in. Identifying letters or numerals shall be as specified in the Contract Documents or as directed by the Engineer.

950.08 SIGNS. The manufacturer or supplier shall furnish certification as specified in TC-1.02.

950.08.01 Sheet Aluminum Sign Panels. Sign panels shall conform to B 209, with an anodized mill finish. Alloys shall be either 6061 T6 or 5052-H38.

950.08.02 Extruded Aluminum Sign Panels and Edge Strip. Extruded aluminum sign panels and edge strip shall conform to B 221, alloy 6063 T6.

950.08.03 Hardware. Hardware shall be clear anodized, conforming to one of the following: B 209, alloy 2024 T4; B 211, alloy 2024 T4, 6262 T9, 6061 T6, 7075 T6 or 2017 T4.

950.09 STEEL SPAN WIRE. Steel span wire shall be 1/4 or 3/8 in. diameter, seven wire strand, galvanized as specified in A 475, Class C.

950.10 CONDUIT. Conduit shall conform to Section 805 and 921.07.

950.11 ELECTRICAL CONDUIT DETECTOR TAPE. Electrical conduit detector tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. The foil shall be 3 in. wide with a tensile strength of 60 lb. The plastic film shall have a minimum thickness of 4.5 mil.

950.12 LUMINAIRES AND LAMPS. The luminaire shall be a complete lighting device consisting of a housing, support clamp, reflector, refractor or flat lens, socket, lamp, integral ballast, terminal block, associated hardware, and necessary wiring. All parts of the luminaire shall incorporate the latest ratings and design improvements. Luminaires shall incorporate individual photoelectric cells when specified. Exposed hardware shall be stainless steel.

950.12.01 Luminaire Construction.

- (a) The bracket arm mounted luminaire housing shall be cast aluminum with natural finish. The housing shall contain and support the reflector, refractor or flat lens, socket, ballast,

terminal block and support clamp. Provisions shall be made for leveling and adjusting the luminaire to the specified transverse and longitudinal position to the roadway.

The refractor or flat lens retaining ring shall be securely latched with an operable hinge made from noncorrodible material.

The reflector shall be of specular polished alzak aluminum or equivalent aluminum reflective surface. It shall be held firmly in the housing but easily removed without the use of special tools. Silicone rubber, ethylene propylene terpolymer, dacron felt gaskets, or other gasketing materials as approved by the Engineer, shall seal the optical assembly at the socket entry and between the refractor and reflector to make a dust tight optical system. The reflector shall be clean and free from scratches.

Glass for the refractor or flat lens shall be heat resistant, borosilicate glass and shall be free of imperfections. The optical system of the luminaire shall clearly indicate the street side and curb side.

The socket shall be a mogul screw shell with large center contact spring providing a firm contact with the lamp base. The socket shall have lamp grips to prevent the lamp from loosening. The shell shall be of the skeleton type or shrouded in porcelain. The contacts shall be identifiable. Socket extension adapters will be permitted for special applications when directed by the Engineer. Luminaires providing various ANSI/IES type of distribution by socket adjustment shall also include a means of identification to associate each lamp position with each distribution type. The socket adjustment shall provide positive positionings by means of index holes, lugs or notches. Slots with infinite settings are prohibited.

The ballast shall be a high power factor, auto regulator type, capable of operating from a multiple circuit and shall operate a high intensity discharge lamp of the type, wattage, and voltage specified. Multi tap ballasts shall be provided where supply voltage is 277 volts or less. The ballast shall start the lamp at temperatures as low as -20 F, and shall deliver rated lamp current at circuit voltage variation of plus or minus 10 percent. The primary power factor shall not be less than 90 percent with normal secondary load. The ballast assembly shall be provided with plug in connectors and installed on a hinged door to permit ready interchange of ballast.

Glare shields shall be provided on luminaires where specified in the Contract Documents or as directed by the Engineer. The glare shield shall cut off the upward component of light but shall not reduce the total output of the luminaire more than 3 percent.

- (b) Bridge underpass luminaires shall be a complete lighting device, consisting of a cast aluminum housing, a door with cast aluminum frame, and thermal shock resistant glass refractor attached to the frame with a stainless steel latch, hinges and retaining chain, a specular polished alzak aluminum reflector, a shrouded adjustable porcelain socket and an integral ballast as specified above.

The refractor and reflector shall direct all useful light well below all normal driver viewing angles to assure that glare will be at a minimum.

- (c) Sign lighting luminaires shall be mercury vapor. A mercury vapor luminaire shall consist of a luminaire housing and a refractor/door assembly constructed of die cast aluminum. The refractor shall be a single piece molded thermal shock resistant borosilicate glass convex lens with discrete prism patterns. The refractor shall be permanently sealed to the door assembly with silicone adhesive around its perimeter. The reflector shall be a single piece dieform of sheet aluminum alloy 3002 or as approved by the Engineer, processed to Alcoa Class SI alzak finish. A heavy duty mogul lampholder shall be securely mounted to the reflector with a galvanized steel bracket. The refractor/door assembly shall be nonpermanently sealed to the luminaire housing and reflector assembly with a single piece neoprene gasket to effectively seal the luminaire and locked in place by stainless steel spring-loaded latches. The refractor/door assembly shall open and be held captive by double pivot internally mounted stainless steel hinges, and it shall be removable.

Weepholes shall be provided in the bottom of the housing in the lowest area of the luminaire as normally mounted.

The sign lighting luminaire shall be designed to properly illuminate the sign with the lamp source type and size as specified in the Contract Documents. The Contractor shall submit for the approval of the Engineer, working drawings showing locations and aiming angles of luminaires with relation to each of the signs of the various sizes.

950.12.02 Lamps shall be provided for luminaires of the type and wattage specified in the Contract Documents. Lamps shall be first line,

high quality and will be as approved by the Engineer. Lamp wattage, horizontal or vertical initial lumens, rated lamp life, and percent of initial lamp lumens at end of rated lamp life shall be as follows:

TYPE	WATTS	INITIAL LUMENS	RATED LIFE (10 hr/start)	PERCENT INITIAL LUMENS
Deluxe Mercury	175	8 600	24 000	74
Deluxe Mercury	250	12 100	24 000	74
Deluxe Mercury	400	22 500	24 000	60
H.P. Sodium	100	9 500	20 000	74
H.P. Sodium	150	16 000	24 000	74
H.P. Sodium	200	22 000	24 000	72
H.P. Sodium	250	30 000	24 000	73
H.P. Sodium	310	37 000	24 000	72
H.P. Sodium	400	50 000	24 000	73
Metal Halide	250	20 000	10 000	80
Metal Halide	400	40 000	15 000	80

950.13 CONTROL AND DISTRIBUTION EQUIPMENT.

Control and distribution equipment enclosures shall be dead front type weatherproof metal enclosed self-supporting structures, as specified in the Contract Documents. Free standing enclosures shall be fabricated from sheet aluminum and shall be as specified herein. Panel and control equipment cabinets shall be the manufacturer's standard enclosure for the type and application specified.

950.13.01 Circuit Breakers. Circuit breakers shall be molded case type having a minimum rating of 10 000 amp interrupting capacity (AIC) and be quick make, quick break, thermal magnetic, trip indicating, and have common trip on all multiple breakers with internal tie mechanism. They shall have the current and voltage ratings and number of poles as specified in the Contract Documents, and shall be treated to resist fungus and be ambiantly compensated for the enclosure and proximity to adjacent breakers. All circuit breakers shall be the bolt in type.

950.13.02 Photoelectric Controls. Photoelectric controls shall be solid state, cadmium sulfide type with hermetically sealed silicone rectifier rated 120 volts, 60 cycle AC and 1000 watts maximum load. Built in surge protection shall be provided, and a fail safe operating feature shall be included so that the lighting circuits will remain energized in the event the photo control components become inoperative. Nominal operating

levels of this control shall turn on at a minimum vertical illumination value of 3 FC and turn off at a maximum vertical illumination value of 6 FC. These limitations shall be set by the manufacturer, and tolerances of plus or minus 20 percent for the specified value will be acceptable.

Photoelectric controls for luminaires and lighting controls shall be twist lock type. A suitable mounting bracket with locking type receptacle and all other necessary mounting hardware shall be furnished.

950.13.03 Contactors and Relays. Contactors of the current ratings and number of poles specified in the Contract Documents shall be held by permanent magnets. They shall be fully rated for all classes of load to 600 volts AC and shall have an interrupting rating of 600 percent of rated current. A HAND-OFF-AUTOMATIC selector switch shall be provided in the photoelectric cell circuit. Relays shall be the type, size and contact ratings as specified in the Contract Documents.

950.13.04 Panel Boards. Panel boards shall conform to Federal Specification W-P-115 and shall be suitable for operation on the voltage and type service specified in the Contract Documents. They shall be listed and labeled by the Underwriters' Laboratories, Inc. Panel boards shall be equipped with the number and size circuit breakers specified. Circuit breakers in panel boards shall conform to Federal Specification W-C-375 and shall be bolted to copper busses. Buss ratings shall be as specified.

950.13.05 Lightning Arresters. Lightning arresters shall be secondary type, having the specified number of poles and 0-650 volts RMS. Arresters shall be provided with suitable mounting brackets and all other necessary mounting hardware.

950.13.06 Control Power Transformers. Control power transformers shall be the dry type, two windings, of the size and voltage ratings specified in the Contract Documents.

950.13.07 Enclosures. Enclosures shall conform to the NEMA type specified. They shall have door clamps, solid neoprene gaskets, welded seams, stainless steel external hardware and continuous hinges with stainless steel pins. Enclosures shall have two weepholes in the bottom and shall be equipped for padlocking.

950.13.08 Pad Mounted Enclosures. For ventilation, all cabinets shall be provided with louvered vents in the front door with a removable air filter.

- (a) Louvers shall satisfy the NEMA Rod Entry Test for 3R rated ventilated enclosure.

- (b) Filters for all cabinets shall be 16 in. long, 12 in. wide, and 1 in. thick. The filter shall cover the vents and be held firmly in place with top and bottom brackets and a spring loaded upper clamp.
- (c) Exhaust air shall be vented out of the cabinet between the top of the cabinet and the main access door. The exhaust area shall be screened with a screen type material having a maximum hole diameter of 1/8 in.

950.13.09 Thermostats and Fans. A thermostatically controlled cooling fan shall be provided for all cabinets. The fan and thermostat shall be rated for 125 percent of capacity and they shall be mounted at the top of the cabinet.

- (a) Thermostats shall be the inline type, single pole, 120 volts, 10 amps with a minimum range of 40 to 80 F.
- (b) The fan shall have a minimum rated capacity of 100 CFM air flow and a minimum rated design life of 100 000 hours.
- (c) The thermostat shall be manually adjustable, within a 10 degree range, from 70 to 160 F.

950.13.10 Disconnect Switches and Utility Connections. Disconnect switches shall conform to NEMA standard KS 1-1990. Disconnect switch enclosure shall be Type 4 stainless steel, with external operating handle, enclosure cover interlock, and external switch mechanism handle with provisions for securing in both the **ON** and **OFF** positions by padlock. The switch mechanism shall be of heavy duty design with quick make, quick break type operations and visible blades.

The disconnect switch shall be fusible with integral fuse puller. Single phase disconnect switches shall have 2 poles with a solid neutral and shall be rated at 240 Vac. Three phase disconnect switches shall have 3 poles with a solid neutral and shall be rated at 600 Vac. The design of the neutral bar may be factory or field installable.

Disconnect switch fuseholders for traffic signals, intersection control beacons, and intersection lighting operating at 120 Vac shall be single phase 60 amps (fused 35 amps).

Disconnect switch fuseholders for hazard identification beacons and luminaires mounted on traffic signal structures operating at 120 VAC shall be rated single phase 30 amps (fused 20 amps).

Disconnect switches for lighting control cabinets shall have the same number of poles and amperage rating specified in the electrical service equipment item.

Disconnect switches for electrical service distribution cabinets shall be 200 amp, 2 pole, single phase.

950.14 ELECTRICAL CABLE AND WIRE CONNECTORS.

950.14.01 Cable Connectors and Connector Kits. Cable connectors and connector kits for use in lighting structures, hand holes, junction or pullboxes and for terminating underground cables in lighting structures shall be rated for a minimum of 600 volt service. Cable connectors shall be compression type, applied by means of a compression tool. Connectors shall be fabricated from high strength copper alloy. Plated connectors fabricated from metals other than copper are prohibited. Bolted type connectors shall be utilized for splicing bare ground conductors.

950.14.02 Connector Kit Components. Each cable connector kit shall be furnished with all component parts described under the various listed types. Each kit shall contain sufficient silicone compound to lubricate metal parts and the housing for each assembly along with complete installation instructions.

- (a) All housings shall be made of water resistant synthetic rubber suitable for burial in the ground or exposure to sunlight. Each housing shall form a watertight seal around the cable at the point of disconnection and between the insert body and enveloping Y housing.
- (b) All copper pins, sockets, and fuse contacts shall have a minimum conductivity of 90 percent. The crimpable portion shall be fully annealed while the rest of the device is maintained in its original state.
- (c) Plastic sleeves shall be rigid, molded insulating plastic material of sufficient outside diameter to form a watertight fit with its related housing. Wall thickness shall be 0.10 in. maximum, and sleeve lengths of 4 and 7 in. shall be available.
- (d) All fuses shall be rated 600 volts, 100 000 amps AIC.

950.14.03 Connector Types. Each cable connector kit furnished shall be one of the following types:

- (a) Type I is an unfused, quick disconnect inline connector kit containing:
 - (1) A copper pin crimpable to a conductor.
 - (2) A receptacle having a centrally located, recessed locking socket constructed so that it is filled and retained by its housing and a disposable assembly pin.
 - (3) A plug housing for retention of the copper pin.
 - (4) A receptacle housing with disposable protective sleeve.
- (b) Type II is a fused, quick disconnect inline connector kit containing:
 - (1) A pair of spring loaded copper fuse contacts suitable for gripping the specified cartridge fuse. One contact shall be crimpable on a conductor and after insertion into its proper position within the load side plug housing, be capable of being securely retained therein. The other contact shall be preassembled for retention within the line side of the connector body.
 - (2) A load side housing permanently marked "Load Side".
 - (3) A disposable assembly pin.
 - (4) A fuse of the specified amp rating.
- (c) Type III is a fused, quick disconnect Y connector kit containing:
 - (1) A pair of spring loaded copper fuse contacts suitable for gripping the specified cartridge fuse. One contact shall be crimpable on a conductor and after insertion into its proper position within the load side plug housing, be capable of being securely retained therein. The other contact shall be preassembled for retention within a Y insert body.
 - (2) A line side Y housing with two water seal cable ports.
 - (3) Two terminal lugs, each having a mounting hole.
 - (4) A bolt and a self-locking nut.
 - (5) A Y insert body with preassembled line side fuse contact and a ring tongue terminal.

- (6) A load side plug housing permanently marked "Load Side".
- (7) A disposable assembly pin.
- (8) A fuse of specified amp rating.
- (d) Type IV is an unfused, quick disconnect Y connector kit containing:
 - (1) A copper pin crimpable to a conductor and suitable for retention in the load side receptacle housing.
 - (2) A Y insert body with preassembled load side copper socket and ring tongue terminal.
 - (3) A line side Y housing with two water seal cable ports.
 - (4) Two terminal lugs, each having a mounting hole.
 - (5) A bolt and self-locking nut.
 - (6) A load side receptacle housing.

950.15 TRAFFIC SIGNAL HEADS. Pedestrian signal indications and vehicular signal heads shall conform to the latest revision of the Institute of Transportation Engineers (ITE) Specifications.

- (a) All materials shall be clean, smooth, and free from flaws, cracks, blowholes, and other imperfections.
- (b) Signal heads shall be furnished with the section assembled together including all hardware as specified in the Contract Documents.
- (c) All metallic signal head hardware shall be stainless steel material.
- (d) Vehicular, optically-programmed and pedestrian signal heads shall be capable of mating to the same type of the signal heads from either the top or bottom of each housing.
- (e) All hardware furnished shall be installed on the corresponding fitting and threaded component.

Mounting hardware shall conform to the following:

ITEM	DESCRIPTION	A	B	C	D
1	Aluminum Alloy - Casting	A 319	A 380	A 713	6063 T6
2	Yield Strength, ksi	18	23	25	25
3	Tensile Strength, ksi	27	47	35	30
4	Brinell Hardness	70	80	75	73
5	Elongation (% in 2 in.)	1.5	4	3	12
6	Stainless Steel	A 316	-	-	-
7	Galvanized Steel	A 157	A 153	G 60	-
8	Steel-Flat Sheet	16 gauge	-	-	-
9	Coating	*	Anodized Finish	-	-

* The signal head housing shall be yellow in conformance with Federal Standards 595, Color Chip No. 13538. The signal head door and visor shall be optical flat (dull) black Federal Standards 595, Color Chip No. 37038. Aluminum signal heads shall be painted using fusion bonded polyester coating method.

Hardware.

Hub plate shall conform to A, 1 thru 5 and 9B.

- (a) Span wire hanger clamp shall conform to C, 1 thru 5.
- (b) Balance adjuster shall conform to 6A, 7A, and 7B.
- (c) 2-way lower arm shall conform to 7C and 8A.
- (d) 2-way tri-stud arm shall conform to A, 1 thru 5.
- (e) Span wire entrance fitting shall conform to C, 1 thru 5.
- (f) Mast arm mount signal bracket (1-way, 2-way, and 5-section) shall conform to 1A and 1D.
- (g) Side pole upper and lower arm assembly shall conform to 1B thru 5B or 1D thru 5D.

Vehicular Signal Heads and Pedestrian Signal Indications Housings and Doors.

- (a) Aluminum signal head housings and doors shall be die-cast aluminum as specified in the Institute of Transportation Engineers Vehicle Traffic Control Signal Head Specification.

- (b) Dual hinge-latch mechanisms shall be mounted on the signal head housing and not the signal head door.

Captive door latch mechanisms (one for 8 in. and two for 12 in. vehicular signal heads, and one for 9 in. and two for 12 in. pedestrian signal indications) shall secure the door to the housing by use of stainless steel eyebolts and wing nut assemblies.

- (c) All openings to the housing interior shall be provided with a gasket conforming to the physical properties listing in UL 508 and that forms a weather tight seal.

Visors.

- (a) Visors shall be as specified in the Institute of Transportation Engineers Vehicle Traffic Control Signal Head Specification and shall be tunnel type. Visors shall be 10 in. deep for 12 in. vehicular signal heads, 8 in. deep for 8 in. vehicular signal heads, 9 in. deep for 12 in. pedestrian signal indications, and 9.5 in. deep for optically programmed signal heads.
- (b) Visors shall be secured to the signal head door by a minimum of four screws mounted perpendicular to the face of the signal head door.
- (c) Visors for aluminum vehicular signal and pedestrian signal sections shall be made from aluminum alloy sheet. Visors for polycarbonate signal sections shall be either formed from sheet plastic or assembled from one or more injection, rotational, or blow-molded polycarbonate sections.

Optical System. Optical system for vehicular and pedestrian traffic control signal indications shall conform to the following.

- (a) **Signal Head Lamps.** Signal head lamps shall be approved by the Office of Traffic & Safety (OTS).
- (b) **Reflector.** Reflector shall be made of aluminum.

Reflector support assembly shall be die cast aluminum, separate from the reflector and fully encompass the periphery of the reflector.

Reflector support assembly shall be spring hinged to allow access to the rear of the signal head main body without the use of tools.

- (c) **Lens.** Lens shall be standard (ball) red, yellow, or green, or specified arrow red, yellow, or green traffic signal lens.

The lens shall be glass.

Directional arrow lenses shall have the same brilliance, regardless which direction they are positioned in the signal face.

The lens shall fit into a one-piece slotted neoprene lens gasket designed to provide a weather resistant fit to the housing door. Lenses shall be secured by a flat clip/screw design fastened from the inside of the signal head door perpendicular to the face of the door. The flat clip/screw design shall not pass through the lens itself.

All pedestrian signal heads shall provide the messages of “walk” and “don’t walk” in the international walking person and the raised hand symbols.

Optical System for Optically Programmed Signal Heads.

- (a) The indication from the lens shall conform to the requirements of ITE transmittance and chromaticity standards.
- (b) Optically programmed signal heads shall have an optical system containing a color filter, lamp fixture, lamp collar, optical limiter/diffuser, and objective lens.
- (c) Lamp fixtures shall be comprised of a separately accessible housing and integral lamp support, indexed ceramic socket, and self-aligning and quick release lamp retainer. Electrical connection between case and lamp housing shall be accomplished with an interlock assembly that disconnects the lamp holder when opened.
- (d) The optical limiter shall provide an accessible imaging surface at focus on the optical axis for objects 900 to 1200 ft distance and permit an effective veiling mask to be variously applied as determined by the desired visibility zone. The optical limiter shall be composed of heat-resistant glass.
- (e) Optically programmed signal heads shall utilize incandescent PAR type lamps. The lamp shall be coupled to the diffusing element. The diffusing element may be discrete or integral with the convex surface of the optical limiter.

- (f) The objective lens shall be a high resolution annular incremental lens hermetically sealed within a flat laminate of weather resistant acrylic or as approved by OOTS. The lens shall be symmetrical in outline and may be rotated to any 90 degree orientation about its axis without displacing the primary image.

Electrical.

- (a) The entire signal head assembly shall be either listed or labeled by a Maryland State Fire Marshall or a recognized electrical inspection agency.
- (b) Wiring connections at the lamp socket shall lock and not be of the male/female demountable type.
- (c) A unitized bail wire with integral spring shall secure the socket to the rear of the reflector. The lamp socket shall have a serrated base to permit locking.
- (d) Each single section and the middle section of three section signal heads shall have a minimum of a six section, twelve position terminal block capable of accepting three number 14 AWG spade terminal ends. The top section of two section pedestrian signal indications shall be furnished with a minimum of five section, ten position terminal blocks capable of accepting three number 14 AWG spade terminal ends.
- (e) Optically programmed signal heads shall not contain a resistance device for use as an intensity controller with integral means for regulating its intensity between limits as a function of individual background illumination.